

Letter to the Editor

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SEVEN-DAY TESTS AND CHRONIC TESTS

To the Editor:

The article "Predicting Chronic Toxicity With Fathead Minnows" by Teresa J. Norberg-King [1] presents valuable data concerning the 5 or 7 d larval (5-7dL) test with fathead minnows. However, the literature review and the analysis of results give the reader the impression that the 5-7dL and the early life-stage (ELS) tests are equivalent to chronic (i.e., life cycle—LC) tests. For example, the author states that ELS tests "have been shown to be reliable predictors of chronic toxicity for many species," and that "the [5-7dL] test is a reliable technique for single toxicants and should be equally useful for estimating the chronic toxicity of effluents." However, no reference was made to the conclusions of a paper published two years ago in this journal showing that on the basis of either statistical significance or biological effects levels, chronic values (ChVs, formerly known as MATCs) from ELS tests do not reliably correspond to thresholds for chronic toxicity [2].

Norberg-King's criterion for prediction of chronic toxicity is "factor of two agreement" between ChVs calculated by statistical significance tests. Scrutiny of the author's Tables 1 and 3 reveals that of the 24 reported 5-7dL results for the five chemicals that have LC test results for fathead minnows, only 8 (33%) have ChVs that fall within a factor of two of the LC ChVs. Allowing a factor of three difference to include tests that are close to "within a factor of two" still results in only 15/24 (62.5%) correspondence. Four of the five chemicals (80%) used for comparison had some 5-7dL ChVs that missed the LC ChV by more than a factor of three, and, as the author acknowledges, all of the 5-7dL ChVs for 2/5 (40%) of the chemicals miss the LC ChV by approximately a factor of 10. Thus, the 5-7dL test often fails to predict chronic effects by the author's criterion.

A more valid basis for evaluating toxicity is the relationship between the magnitude of exposure and the magnitude of effects, and by this criterion the 5-7dL test fails even more regularly to predict chronic toxicity. Because of the peculiarities of hypothesis testing statistics, the thresholds for statistically significant effects (ChVs) can correspond to concentrations that induce large biological effects

[2]. Consequently, 5-7dL ChVs may not be protective even when they agree with LC test ChVs. For example, Norberg-King's 5-7dL ChVs for Zn ranged from 183 to 412 µg/L. Zinc concentrations in this range induced an 83 to 98% reduction in the number of eggs per female in one fathead minnow LC test [3] and, in another fathead minnow LC test, reduced parental-generation survival from 92 to 46% and reduced the number of eggs on the spawning substrates by 92% apparently due to parental consumption of nonadhesive or damaged eggs [4]. Hence, although 5/7 of the 5-7dL ChVs for Zn are within a factor of two of the LC ChV, they clearly are not protective of fathead minnow life cycles.

For practical and economic reasons, 5-7dL tests may be the best tests of effluent toxicity. However, we should not try to convince ourselves that an acute test (i.e., one that includes only one life stage and has a duration of less than 1% of the lifespan of the test organism) is some sort of chronic test. The 5-7dL test is predictive of chronic toxic effects in the sense that the 96 h LC50 is predictive of chronic toxic effects; they are correlated, but the error in the correlation is large. Accurate predictions of chronic toxicity still require chronic tests.

Glenn W. Suter II
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¹Operated by Martin Marietta Energy Systems, Inc., under contract DE-AC05-84OR21400 with the U.S. Department of Energy. Publication No. 3527, Environmental Sciences Division, ORNL.

SUTER, 1990